SuperShuttle Focus Fleet Study
Interim Project Report
November 1999

Introduction

This report is intended to update project participants on the technical progress of the fleet evaluation. Six months of operational data and the results of the first round of emissions tests are presented here. The data collection is expected to conclude by the end of March 2000. NREL will then publish a final technical report and a short summary of the findings.

This focus fleet study is jointly sponsored by GRI* and the U.S. Department of Energy (DOE) and is being conducted for DOE's Field Operations Program by the National Renewable Energy Laboratory (NREL). A focus fleet study is a detailed evaluation of a particular fleet's experience with implementing and operating alternative fuel vehicles (AFVs). For this type of study, we collect, analyze, and report on operational, cost, emissions, and performance data from AFVs being driven in a fleet application. The primary purpose of such studies is to make real-world information on AFVs available to fleet managers and other potential AFV purchasers. Fleet representatives who are considering AFVs can use this information as they make their decisions about what type of fuel or vehicle will best meet their needs.

This evaluation could not be completed without the participation of several industry partners:

- SuperShuttle Denver, which serves as the host fleet, purchases the vehicles and supplies operational data.
- Natural Fuels provides fuel, advises SuperShuttle on financial and technical issues, and manages the emissions testing contract.
- Ford Motor Company offers technical assistance and rebates on the fleet vehicle purchases.
- Sill-Terhar Ford dealership services the vehicles.
- Environmental Testing Corporation conducts the emissions tests.

Background

For this project, data are being collected from 13 passenger vans operating in the Boulder/Denver, Colorado, area. The study vehicles are all 1999 Ford E-350 passenger vans based at SuperShuttle's Boulder location. Five of the vans are dedicated compressed natural gas (CNG), five are bi-fuel CNG/gasoline, and three are standard gasoline vans that are being used for comparison. These vehicles are part of a larger

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* On October 1, 1999, GRI changed their name and corporate logo. They are no longer Gas Research Institute; they are now GRI -- a technology solutions company for the energy industry. For more information see their web site at www.gri.org

fleet that SuperShuttle Denver operates. In all, the fleet runs 85 vehicles, 18 of which are AFVs. In addition to the CNG vans in the study, SuperShuttle has several propane shuttle buses. Table 1 summarizes the specifications of the study vehicles.

Table 1. Vehicle Specifications

Make	Ford	Ford	Ford
Model	E-350 van	E-350 van	E-350 van
Model Year	1999	1999	1999
Engine Family Code	XFMXT05.4RP6	XG9XT05.46GN	XFMXH05.4BBF
Engine Displacement	5.4L	5.4L	5.4L
Engine Configuration	V8	V8	V8
Compression Ratio	9.1	9.1	9.1
Combustion	stoichiometric	stoichiometric	stoichiometric
Horsepower	200 @ 4500 rpm	200 @ 4500 rpm (CNG)/ 235 @4250 rpm (gas)	235 @ 4250 rpm
Torque	290 ft lb @ 2250 rpm	290 ft lb @ 2250 rpm (CNG)/ 335 ft lb @3000 rpm (gas)	335 ft lb @3000 rpm
Catalyst	3-way	3-way	3-way
Fuel/system	CNG/dedicated	CNG/bi-fuel	gasoline
Fuel Tank Capacity	14 gge[1]	8.5 gge[1] CNG/ 35 gal gasoline	35 gal
GVWR[2] (lb)	9400	9400	9400
Passenger Capacity	15	15	15
Certification Standard	CA SULEV[3] Federal ULEV/ILEV[4]	LEV[5] (CNG) Tier 1 (gasoline)	Tier 1

[1] gasoline gallon equivalent
[2] gross vehicle weight rating
[3] California super-ultra low emission vehicle
[4] federal ultra-low emission vehicle/inherently low emission vehicle
[5] low emission vehicle

The vans are being operated in two basic types of service: in-town shuttle around the Boulder area (mostly stop-and-go driving), and intra-city service between Boulder and Denver International Airport (DIA, highway driving at higher speeds). Boulder is approximately 45 miles from Denver, and the vans are expected to accumulate about 70,000 miles per year. Because of the high mileage application and the opportunity to evaluate the technology options in a side-by-side comparison, SuperShuttle is an excellent choice for a study fleet.

The data collection period began in March 1999, when the first vans arrived at the site, and will continue for 12 months. Data on operating and maintenance records and costs are being collected, along with the results of three rounds of emissions tests.

Data Collected

Operational Data

Operational data include maintenance and repair records (scheduled and unscheduled), fuel usage and cost, and mileage records. NREL staff members are collecting these data from several sources. Each month, SuperShuttle's shop manager supplies maintenance, repair, and mileage reports. At its Boulder location, SuperShuttle employs mechanics who perform all scheduled maintenance along with some unscheduled service. SuperShuttle follows the manufacturer's recommended intervals for scheduled maintenance as closely as possible. At each service, mechanics change the oil and oil filter, perform any other scheduled service based on the odometer, and conduct a thorough inspection of the vehicle and its systems. Sill-Terhar Ford, located in Broomfield, Colorado, completes all warranty work and other unscheduled repairs. Copies of the work orders from both the SuperShuttle garage and from the Sill-Terhar dealership are part of the monthly data submission.

Vehicle drivers are responsible for fueling the vehicles they operate. Each CNG and gasoline vehicle is assigned a credit card to use when making all fuel purchases. The date, time, quantity of fuel, and price are all recorded automatically for each fuel purchase, but odometer readings must be entered by the driver at each fueling. To date, there have been some problems with collecting accurate odometer readings; we'll cover these problems later in this report.

Natural Fuels, the fuel provider, transfers the CNG fueling records to NREL electronically in a spreadsheet. Gasoline fuel records are submitted by SuperShuttle in hard copy form each month.

Emissions Data

Three rounds of emissions tests will be performed on the 13 study vans. These tests will follow the EPA's Federal Test Procedure (FTP-75). Results from FTP tests typically include non-methane hydrocarbons (NMHC), carbon monoxide (CO), oxides of nitrogen (NO_x), methane (CH_4), and carbon dioxide (CO_2). A detailed description of the procedure can be found in the *Code of Federal Regulations* (CFR 40 Part 86, http://www.epa.gov/epahome/cfr40toc.htm). The tests are scheduled at odometer levels of approximately 10,000 miles; 40,000 miles; and 70,000 miles over the course of the year-long data collection. During the second round of testing, three vans of each type will undergo more detailed testing, which will include aldehyde analysis of the FTP samples, an evaporative test, and additional tests to measure emissions under aggressive driving (US06) and cold conditions (Cold CO). Table 2 is a matrix of the planned tests.

Table 2. Emissions Test Matrix

Vehicle Type	Fuel	Round 1	Round 2			Round 3
		10,000 mi	40,000 mi			70,000 mi
		# FTP	# FTP	# US06	# Cold CO	# FTP
Dedicated CNG	CNG	5	5	3	3	5
Bi-fuel CNG	CNG	5	5	3	3	5
	Gasoline	5	5	3	3	5
Gasoline	Gasoline	3	3	3	3	3
Total		18	18	12	12	18

The gasoline test fuel, referred to as RFA, represents an industry-average blend. Fuel for cold tests must be adjusted to a winter-grade fuel. Table 3 gives some of the properties of the gasoline test fuels used in this program. The CNG test fuel is taken from the fueling station located at DIA. The CNG from this station is similar to that of the national average and is closely monitored throughout the year. A single batch of fuel for each round is taken from the site and stored in a fuel trailer for use by the test lab. Quality control analysis is performed on a sample of each batch. Table 4 gives the composition of the CNG fuel used during the first round.

The dedicated vans (CNG and gasoline) are being tested on their respective fuels; the bi-fuel vans are being tested on both CNG and RFA.

Table 3. Gasoline Test Fuel Specifications

Fuel Properties	RFA	Cold CO
Specific Gravity	0.75	0.73
Sulfur (ppm)	328	334
Reid Vapor Pressure (pounds/square inch)	8.9	11.5
Aromatics (% by volume)	33.2	26.2
Olefins (% by volume)	10.1	9.7
Saturates (% by volume)	56.7	64.1

Table 4. Composition of the CNG test fuel

Compound	Mole %
Methane	90.98
Ethane	5.16
Propane	0.86
Isobutane	0.11
N-Butane	0.13
Isopentane	0.04
N-Pentane	0.03
Hexanes+	0.05

Fleet Implementation Experience

During this study, NREL is also collecting more subjective data to document this fleet's experience with implementing AFVs. We ask fleet representatives questions such as why they chose a particular fuel or vehicle, what kind of incentives were available to them, and what changes they made to incorporate AFVs into their fleet. Answers to these types of questions, along with the more quantitative data collected, should help other fleet managers make decisions on what will work best in their particular fleet applications.

Some of this information was published in a Fleet Start-Up Experience Brochure, which can be downloaded at the following DOE World Wide Web site:

www.ott.doe.gov/otu/field_ops/lightduty.html

In addition to information on vehicle and fuel choices, NREL conducts surveys of fleet personnel and customers to determine opinions, perceptions, and acceptance of AFV technology. These surveys are in progress, and the results will be presented in the final report. The customer survey questionnaire can be found in the appendix.

Summary of Preliminary Results

Operating Data Results

Vehicle Usage

SuperShuttle Boulder operates its vehicles three shifts per day, seven days per week.

Although all the 13 study vans are operated for at least one shift per day, some are used for two or three shifts. Drivers are not assigned a particular vehicle, but instead choose their vehicle at the beginning of each shift. Some of the vans shuttle passengers to and from DIA, usually making three round trips during a shift. Other vans shuttle passengers around the Boulder area.

By the end of August 1999, the study vans had accumulated from 18,000 miles to more than 36,000 miles. Table 5 lists vehicle usage for the first 6 months. The gasoline vans accumulated the most miles and the dedicated CNG vans accumulated the fewest miles. The gasoline vehicles have higher total miles in part because they arrived several weeks before the first AFVs and were put into service immediately. Because the AFVs did not go into service until mid March, the calculations for average monthly mileage listed in the table include the mileages from April through August. The average monthly mileage accumulation for the gasoline and the bi-fuel vans has been higher than that of the dedicated CNG vans. The gasoline and bi-fuel CNG vans are being used in a similar percentage of short in-town and longer airport trips. However, mainly because of the fleet's concern with vehicle range, the dedicated CNG vans are being used mostly in local service around Boulder. With an average fuel economy of 10.4 mpeg (miles per gasoline gallon equivalent), the dedicated CNG vans should have a range of around 145 miles per fill. Although this is more than enough for a round trip to the airport, drivers don't always have adequate time in their schedules to fuel between trips.

Table 5. Vehicle Mileage Data

ID number	Type	Total miles	Total Months in service	Avg. Miles Accumulated per Month*
231	Gasoline	35857	6	5648
232	Gasoline	36728	6	5909
233	Gasoline	36228	6	6045
	Average	36271		5867
234	Dedicated CNG	18035	5.5	3141
235	Dedicated CNG	20662	5.5	3663
236	Dedicated CNG	18325	5.5	3333
237	Dedicated CNG	22084	5.5	4048
238	Dedicated CNG	19965	5.5	3675
	Average	19814		3572
239	Bi-fuel CNG	29815	5.5	5548
240	Bi-fuel CNG	30796	5.5	6038
241	Bi-fuel CNG	23924	5.5	4660
242	Bi-fuel CNG	32195	5.5	6296
243	Bi-fuel CNG	27163	5.5	5315
	Average	28779		5571

* calculated average is for April – August

Fuel Economy and Cost

Table 6 summarizes the fuel economy data for the study vans. The average fuel economy and fuel costs are listed for each van type. Results are based on fueling records from March 1999 through August 1999. The fuel economy for the gasoline and dedicated CNG vans was calculated by taking an average of all the individual fueling records submitted.

Because the bi-fuel vehicles can be operated on either CNG or gasoline, this calculation is more complicated. It was not possible to calculate a separate gasoline and CNG fuel economy from the data collected thus far. In this case, average fuel economy for the bi-fuel vans was calculated based on monthly odometer readings and total fuel used. Future plans to determine separate fuel economy for gasoline and CNG include operating these bi-fuel vehicles on one fuel for 2 consecutive weeks followed by 2 weeks on the other fuel.

Table 6. Fuel Economy Data Summary

Vehicle Type	Average Fuel Economy (mpeg)	Fuel Cost (cents per mile)
Dedicated CNG	10.36	8.28
Bi-Fuel CNG	10.71	9.91
Gasoline	11.04	9.97

The average fuel economy for the dedicated CNG vans was approximately 6% lower than that of the gasoline vans. The average fuel economy for the bi-fuel vans was also lower than the gasoline controls (3%). The fuel cost per mile reflects a potential savings for fleets using CNG. During the first 6 months, gasoline prices ranged from a low of $0.91 to a high of $1.33, with an average of $1.12 per gallon. CNG prices were very stable, ranging from $0.85 to $0.91 with an average of $0.85 per gasoline gallon equivalent (gge). On a per-mile basis, the dedicated CNG vans were approximately 17% less costly to fuel than the gasoline vans. The cost of fueling the bi-fuel vans was also slightly lower than the gasoline controls on a per mile basis, although the difference was not significant.

As noted previously, the quality of the fueling records collected to date has been problematic. Because the odometer readings are entered at each fueling, accurate records depend on the diligence of the drivers. Obtaining accurate records thus far has been a challenge. The CNG fueling records for the first 4 months of data collection did not include odometer readings at each fueling, because drivers were not prompted to enter the odometer. This problem has been corrected, and drivers must now enter an odometer value in order to fuel their vehicles.

Now, the difficulty lies in getting the drivers to enter the correct odometer value. Although some drivers are quite conscientious, more than half the fuel records through the first 6 months of data collection had to be excluded from the calculations because of negative or very large values. We used statistical methods to determine which values were reasonable, and included these values in the final average. After the analysis, 312 gasoline records and 382 CNG records were used in the final calculations. The numbers presented here are preliminary, and may not reflect the final averages for the entire collection period. All the fueling records will be reviewed in detail when the project is complete and before final calculations are made.

Maintenance and Repair Summary

Eighty maintenance records were collected on the 13 vans for the first 6 months: 29 for the gasoline control vans, 20 for the dedicated CNG vans, and 31 for the bi-fuel CNG vans. Because of the difference in total accumulated miles for the three different types of vans, these data were somewhat skewed. The gasoline vans all had accumulated more than 30,000 miles, and so had required more services. When using the entire data set, the gasoline vans had been in for service an average of 5.8 times per vehicle; the dedicated CNG vans had been in for service an average of 4 times per vehicle. For this reason, we chose to use 20,000 miles as a cutoff to give a balanced data set.

Scheduled maintenance included oil changes, air filter changes, and brake inspections for all vehicles. There were no unscheduled repairs on any of the vans under the 20,000 mile cutoff. Table 7 summarizes the maintenance data for the three types of vans. Warranty repair costs, although collected, were not included in the total cost, because the fleet does not pay for warranty repairs.

Table 7. Summary of Maintenance and Repair Costs (up to 20,000 miles)

Vehicle Type	Total Cost ($)	Total Vehicle Miles	Cost (cents per mile)
Dedicated CNG	1,863	89,366	1.99
Bi-Fuel CNG	1,498	82,597	1.81
Gasoline	1,063	53,227	1.97

Analysis of the initial data collected indicate that there is not a significant difference in maintenance cost between the gasoline and dedicated CNG vans. The cost per mile for the bi-fuel vans was slightly less than that of the gasoline and dedicated CNG vans. Two of the five bi-fuel vans were brought in for a scheduled service just past the 20,000 mile cutoff. If these records were included in this preliminary analysis, the average cost for the bi-fuel vans would be 1.97 cents per mile.

One gasoline van, three dedicated CNG vans, and two bi-fuel vans received at least one warranty-covered repair during the first 6 months. The most serious involved two of the dedicated CNG vans. Both vans experienced CNG leaks that were repaired at a cost of more than $500 each. Had these vans been out of the warranty period (36,000 miles or 3 years), this would have added to the overall cost of operating the dedicated CNG vehicles. Another concern for the CNG vehicles was with the check engine light on two of the vans. One of the two, dedicated CNG van #238, has been in for repairs two times in the first 6 months. The mass airflow sensor was replaced at the first service, and a vacuum hose was repaired during the second. To date, problems with the check engine light have been reported on all five dedicated CNG vans and two of the bi-fuel vans. Ford has been contacted and is working with SuperShuttle to evaluate and resolve this problem.

Total Operating Costs

The average fuel cost and average maintenance cost are combined to result in the total operating costs of the vehicles (see Table 8). Based on the data collected so far, the dedicated CNG vehicles cost approximately 14% less to operate than the gasoline vehicles. The bi-fuel vehicles cost slightly less (approximately 2%) to operate than the gasoline vehicles. Keep in mind that these are very early results. The trend seen here may or may not continue throughout the year-long data collection period. It is also important to note that more than 80% of the total operating cost to date has been fuel cost. If these trends continue, a fleet operating dedicated CNG vans under similar conditions could see a potential cost savings of around $1100 per year on a vehicle accumulating 70,000 miles annually. The cost savings for bi-fuel vans using a similar ratio of CNG and gasoline would be around $150 per vehicle per year.

Table 8. Summary of Total Operating Costs (cents per mile)

Vehicle Type	Average Fuel Cost	Average Maintenance Cost	Total Operating Costs
Dedicated CNG	8.28	1.99	10.27
Bi-Fuel CNG	9.91	1.81	11.72
Gasoline	9.97	1.97	11.94

Round 1 Emissions Results

An FTP emissions test was performed on each of the 13 vans during the first round at approximately 10,000 miles. Detailed emissions results (including the odometer at the time of testing) can be found in the tables at the end of this report.

Table 9 gives the results from Round 1 including the average for each emissions component, the percent difference between CNG and RFA, and an indication of whether or not the effect between fuels is statistically significant. Percent difference was calculated using the formula:

$$\%difference = \frac{\left(\overline{U}_{CNG} - \overline{U}_{RFA}\right)}{\overline{U}_{RFA}} \times 100$$

Where $\overline{U}$ is the average emissions for the specific fuel. Statistical significance was determined using the statistical software package JMP, developed by the SAS Institute. Using this software, a multi-variable analysis of variance (ANOVA) was performed to determine the statistical significance between the average results from the two fuels. All data were analyzed at the 95% confidence level.

Table 9. Average Emissions Results for Round 1

	Dedicated Vans				Bi-fuel Vans			
	CNG	RFA	% difference	Significant fuel effect	CNG	RFA	% difference	Significant fuel effect
Regulated Emissions (g/mi)								
NMHC	0.011	0.298	-96.4	y	0.022	0.235	-90.5	y
THC	0.116	0.357	-67.5	y	0.416	0.280	48.6	y
CO	0.34	6.14	-94.4	y	6.84	6.37	7.4	n
NO_x	0.056	1.443	-96.1	y	0.880	0.884	-0.5	n
Greenhouse Gases (g/mi)								
CO_2	574.6	747.7	-23.1	y	578.8	726.9	-20.4	y
CH_4	0.106	0.063	67.4	y	0.396	0.048	725.0	y
Fuel Economy								
mpeg	11.2	11.8	-5.5	y	10.9	12.2	-10.4	y

Figure 1 illustrates the average results for NMHC, CO, NO_x, and CO_2 emissions. The graphs show the average values for the dedicated CNG and the standard gasoline vans (left side), as well as the average emissions for the bi-fuel vans tested on both CNG and RFA. The emissions certifications for the vans are also shown on the graphs. The standard gasoline van is certified to the EPA Tier 1 level; the dedicated CNG van is certified as a super ultra low emission vehicle (SULEV); and the bi-fuel CNG van is certified as a low emission vehicle (LEV) when operating on CNG, and Tier 1 when operating on gasoline. It is important to note that the values presented in this report are the results of one round of testing at 10,000 miles.

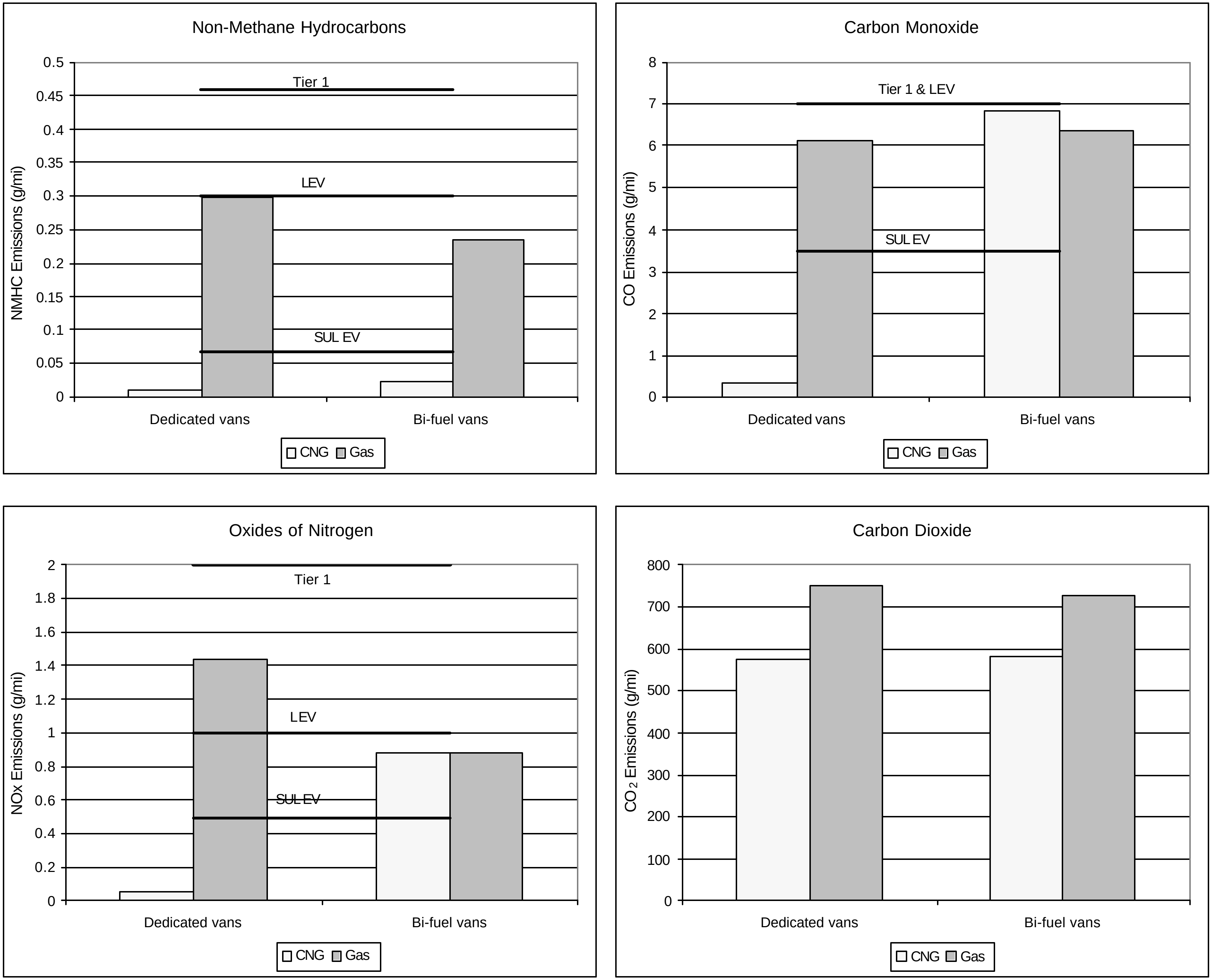
When comparing the average regulated emissions for the dedicated CNG vans to that of the standard gasoline vans; NMHC emissions were 96% lower, CO emissions were 94% lower, and NO_x emissions were 96% lower. Although not a regulated emissions component, CO_2 is considered a greenhouse gas that may contribute to global warming. The CO_2 emissions were 23% lower for the CNG vans. All these differences were statistically significant at the 95% confidence level. Both the dedicated CNG and standard gasoline vans tested below their respective certification levels.

Comparisons between CNG and RFA tests on the bi-fuel vehicles show NMHC emissions were 90.5% lower, CO emissions were 7% higher, and NO_x emissions did not differ significantly. CO_2 emissions were 20% lower for the CNG tests. Of these emissions components, only the NMHC and CO_2 were determined to be significantly different at the 95% confidence level. As with the dedicated CNG and gasoline vans, the bi-fuel vans tested below their certification levels.

Comparison between the CNG tests on the dedicated and bi-fuel vans show that CO and NO_x emissions are significantly higher for the bi-fuel vehicles; there is no significant difference in NMHC and CO_2 emissions.

The fuel economy measured during the FTP test is representative of typical city driving patterns. Comparison of fuel economy between the two fuels shows that the miles per equivalent gallon (mpeg) for the CNG tests is lower than that from the RFA tests. This holds true for both the dedicated and the bi-fuel vans. The average fuel economy for the CNG vans is approximately 5.5% less than that of the gasoline vans. The bi-fuel vans have an average fuel economy on CNG that is 10% lower than when the same vans are tested on RFA.

Figure 1. Average Emissions Results for Round 1 (10,000 miles)



Fleet Implementation Experience

SuperShuttle International has operated AFVs in several locations, including Los Angeles and Phoenix. SuperShuttle management in Denver decided to add AFVs to the Boulder location for several reasons. Because CNG is less expensive than gasoline, SuperShuttle could see considerable savings as the cost of gasoline continues to rise. Also, the rebates and tax incentives available to SuperShuttle made the price of these AFVs comparable to their gasoline counterparts.

Concern for air quality in the area was another reason for choosing clean technology vehicles. The EPA has classified the Denver/Boulder region as a non-attainment area for both CO and particulate matter. Because of the local topography and weather patterns, pollution from urban sources is sometimes suspended over the area, resulting in a "brown cloud." SuperShuttle management knew that the Boulder community would react positively to the environmentally friendly vehicles.

This evaluation could not be implemented without good communication and support from the fuel provider and other industry partners. To make the transition to AFVs easier for SuperShuttle, many factors had to come together. Natural Fuels increased storage capacity at the nearest fueling site to ensure the fleet's supply of natural gas, and also held several training classes for drivers and other fleet personnel to acquaint them with natural gas, natural gas vehicles, and fueling. When the delivery of the 10 AFVs was delayed at the onset of the project, Natural Fuels loaned a CNG van to SuperShuttle until their vans arrived. The local Ford dealership added equipment to service natural gas vehicles, and their technicians attended a course to learn about service and repair of the vans. These efforts have been critical to the success of operating CNG vehicles in this fleet.

Summary

Results from operational data collected for the first 6 months of this project show a potential cost savings for using a dedicated CNG vehicle in this type of fleet application. Bi-fuel CNG vehicles also show a potential for cost savings, although not as large as that for the dedicated vehicles. As the price of gasoline rises, this savings could be considerable. Maintenance data collected indicate that the CNG vehicles cost about the same to maintain as their gasoline counterparts.

The first round of emissions tests (at 10,000 miles) showed that NMHC, CO, NO_x, and CO_2 were all significantly lower for the dedicated CNG vans compared to the gasoline vans. The bi-fuel vans showed mixed results when comparing emissions from the two fuels. When tested on CNG, these bi-fuel vans emitted less NMHC and CO_2, more CO, and about the same NO_x as when the same vans were tested on RFA. Each of the vans, however, tested below their respective EPA certification levels.

Round 2 emissions tests, scheduled for 40,000 miles, began in late September. The Round 3 (70,000 mile) tests should be conducted in early 2000.

The data collection period will end in March 2000. NREL will then publish a final technical report, along with a summary of the key findings. We expect to make both documents available by the end of June 2000.

Detailed Emissions Results for Round 1

Standard Gasoline Vans - Round 1 Results

Vehicle ID	Test Date	Odometer	Fuel	MPG	CH_4	CO	CO_2	NMHC	NOx	THC
SS231GFC	4/17/1999	10209	RFA	11.67	0.06	5.48	758.61	0.2842	1.77	0.34
SS232GFC	4/15/1999	9546	RFA	11.76	0.06	5.38	752.44	0.2875	1.27	0.34
SS233GFC	4/28/1999	9673	RFA	12.03	0.07	7.56	731.96	0.3234	1.29	0.39
			Count	3	3	3	3	3	3	3
			Average	11.82	0.063	6.14	747.67	0.298	1.443	0.357
			STD*	0.187	0.006	1.231	13.951	0.022	0.283	0.029
			CV**	0.016	0.091	0.201	0.019	0.073	0.196	0.081

Dedicated CNG Vans - Round 1 Results

Vehicle ID	Test Date	Odometer	Fuel	MPG	CH_4	CO	CO_2	NMHC	NOx	THC
SS234CF	6/10/1999	8298	CNG	11.04	0.1	0.34	581.39	0.0105	0.05	0.11
SS235CF	6/9/1999	10650	CNG	11.27	0.12	0.25	569.77	0.0052	0.06	0.12
SS237CF	6/9/1999	10594	CNG	11.16	0.09	0.37	575.4	0.0053	0.05	0.1
SS238CF	6/10/1999	8113	CNG	11.11	0.11	0.42	577.85	0.008	0.07	0.12
SS236CF	7/1/1999	9739	CNG	11.29	0.11	0.33	568.85	0.0244	0.05	0.13
			Count	5	5	5	5	5	5	5
			Average	11.174	0.106	0.342	574.65	0.0106	0.056	0.116
			STD*	0.106	0.011	0.062	5.331	0.008	0.009	0.011
			CV**	0.010	0.108	0.182	0.009	0.746	0.160	0.098

Bi-fuel CNG Vans tested on CNG – Round 1

Vehicle ID	Test Date	Odometer	Fuel	MPG	CH_4	CO	CO_2	NMHC	NOx	THC
SS239CF	5/27/1999	9310	CNG	10.8	0.48	8.77	580.38	0.0153	0.96	0.49
SS240CF	6/4/1999	9723	CNG	10.96	0.38	5.92	576.35	0.0226	0.9	0.4
SS241CF	5/28/1999	10601	CNG	10.85	0.31	6.29	581.86	0.0167	0.71	0.33
SS242CF	6/8/1999	10095	CNG	10.83	0.45	9.33	577.53	0.0382	0.83	0.48
SS243CF	6/7/1999	10130	CNG	10.99	0.36	3.91	577.71	0.0185	1	0.38
			Count	5	5	5	5	5	5	5
			Average	10.886	0.396	6.844	578.77	0.022	0.88	0.416
			STD*	0.084	0.069	2.217	2.273	0.009	0.115	0.068
			CV**	0.008	0.174	0.324	0.004	0.419	0.130	0.164

Bi-fuel CNG Vans tested on RFA – Round 1

Vehicle ID	Test Date	Odometer	Fuel	MPG	CH_4	CO	CO_2	NMHC	NOx	THC
SS239CF	5/19/1999	9277	RFA	12.11	0.05	6.45	728.98	0.2272	0.89	0.27
SS240CF	6/3/1999	9697	RFA	12.02	0.05	6.83	733.96	0.237	0.97	0.28
SS241CF	6/1/1999	10645	RFA	12.23	0.04	5.65	722.99	0.2134	0.85	0.25
SS242CF	6/7/1999	10069	RFA	12.23	0.05	6.54	721.86	0.245	0.95	0.3
SS243CF	6/4/1999	10105	RFA	12.15	0.05	6.4	726.96	0.2511	0.76	0.3
			Count	5	5	5	5	5	5	5
			Average	12.148	0.048	6.374	726.95	0.235	0.884	0.28
			STD*	0.088	0.004	0.438	4.869	0.015	0.084	0.021
			CV**	0.007	0.093	0.069	0.007	0.064	0.095	0.076

* = Standard deviation
** = coefficient of variance

Think Nationally
Participate Locally!

Chances are, you wouldn't be on this van if you didn't care about our nation's air quality and dependence on foreign oil. And because the U.S. Department of Energy (DOE) is concerned too, it conducts studies on alternative (non-petroleum) fuels and alternative fuel vehicles (AFVs). This very van is part of one of those studies! The Gas Research Institute and DOE's National Renewable Energy Laboratory (NREL) have joined with several other partners to evaluate these vans that run on compressed natural gas (CNG).

Boulder's SuperShuttle demonstrated its commitment to the local community by agreeing to replace 10 of its gasoline vehicles with new CNG AFVs. Operating these vehicles enables NREL to collect in-service data and publish information that helps U.S. fleets make AFV purchase decisions, gives auto manufacturers perspectives on "real-world" AFV performance, and allows policy makers to formulate clean air and energy security strategies.

How can you get involved? By taking a few minutes during your ride to fill out the brief questionnaire on the reverse. Please give your completed survey to your driver.

We appreciate your participation!

Program Participants: SuperShuttle • U.S. Department of Energy • National Renewable Energy Laboratory • Gas Research Institute • Natural Fuels • Ford Motor Company • Sill-Terhar Ford Dealership • Environmental Testing Corporation

If you're interested in our programs, tear off this card and take it with you.

The Alternative Fuels Hotline
1-800-423-1DOE
and the Alternative Fuels Data Center
http://www.afdc.doe.gov
are available to answer your questions

The Survey

Were you aware that you're riding in an alternative fuel vehicle?
1. Yes 2. No

How important do you consider developing alternatives to petroleum to be?

1. unimportant
2. somewhat unimportant
3. neutral
4. somewhat important
5. very important

Are you aware that natural gas is produced in the United States?
1. Yes 2. No

Rate your feelings about using a compressed natural gas vehicle for transportation:

1. unacceptable
2. somewhat unacceptable
3. neutral
4. somewhat acceptable
5. acceptable

What are your main reasons for the previous choice?

Does a company's use of alternative fuels or other environmentally friendly products influence your decision to use their services?
1. Yes 2. No

Why?

Any other comments?